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(54) **CONTROL INFORMATION SENDING METHOD, DETECTION METHOD, NETWORK DEVICE, AND TERMINAL**

VERFAHREN ZUM SENDEN VON STEUERINFORMATIONEN, DETEKTIONSVERFAHREN, NETZWERKGERÄT UND ENDGERÄT

PROCÉDÉ D'ENVOI D'INFORMATIONS DE COMMANDE, PROCÉDÉ DE DÉTECTION, DISPOSITIF DE RÉSEAU ET TERMINAL

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EP 3 700 270 B1

- LG ELECTRONICS: "Discussion on search space design", 3GPP DRAFT; R1-1717952_SEARCH SPACE DESIGN_FINAL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG1, no. Prague, CZ; 20171009 - 20171013 3 October 2017 (2017-10-03), XP051352833, Retrieved from the Internet:
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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the field of communication technology, in particular to a control information transmission method, a control information detection method, a network device and a User Equipment (UE).

BACKGROUND

[0002] In a conventional mobile communication system, a control channel needs to occupy the entire system bandwidth, as shown in FIG. 1. When detecting the control channel to acquire control information, a UE needs to detect the entire system bandwidth, mainly resulting in the following problems. 1) Because the UE needs to detect the entire system bandwidth, the detection complexity of the control information may increase dramatically when the system bandwidth is relatively large. 2) The UE needs to be provided with a large bandwidth for the reception of the control information, so it is adverse to the flexible configuration of the bandwidth for the UE and the access of a small-bandwidth UE.

[0003] In order to solve the above problems, in the standardization process, one method is to divide a bandwidth available for the control channel within N available Orthogonal Frequency Division Multiplexing (OFDM) systems into M control sub-bands or control resource sets. In this way, the UE merely needs to detect the control information in one control resource set, so as to reduce the detection complexity of the UE, as shown in FIG. 2.

[0004] In a known scheme, the control resource sets are usually mapped to first one, two or three symbols within one slot.

[0005] In a 5th-Generation (5G) system, a multi-beam design is adopted so as to improve the coverage performance. Within one synchronization period, a plurality of Synchronization Signal (SS) blocks, i.e., Physical Broadcast Channel (PBCH) blocks, is used for the synchronization of UEs. Each SS block corresponds to one beam. Here, the control resource set for the transmission of some public system information (similar to System Information Blocks (SIBs) in a Long Term Evolution (LTE) system) is defined as a public control resource set. The optimal design of the public control resource set needs to be provided, so as to improve the transmission reliability of the system information.

[0006] In a conventional transmission method, the public control resource set is placed in first several symbols within one slot and multiplexed with the SS blocks in a time-division manner.

[0007] In this method, in a multi-beam system scenario, a beam scanning operation needs to be performed on each public control resource set. A beam direction is fixed, so it is merely able to schedule the UEs within a

beam range. When there is a relatively large quantity of beams, the scheduling flexibility of the system may be significantly reduced.

[0008] EP 2 854 455 A1 concerns a method for transmitting downlink control information, a detecting method, a base station and a UE. The detecting method includes: the UE detects downlink control information beared by ePDCCH in a resource block according to a resource block set and pre-defined information configured by the base station; wherein the pre-defined information at least includes one of the followings: sub-carrier position information detected in the resource block set, enhanced control channel unit information detected in the resource block set, a mapping mode of the ePDCCH, aggregation level configuration information detected in the resource block set, the amount of candidate set corresponding to the detected aggregation level in the resource block set and a downlink control information format.

[0009] US 2013/201975 A1 concerns techniques for systems that support DMRS-based transmissions, that may allow such systems to at least partially utilize resources in the center six RBs of subframes 0 and 5 for DMRS-based transmissions (e.g., EPDCCH), while avoiding collision with Primary Synchronization Signal (PSS), Secondary Synchronization Signal (SSS) or Physical Broadcast Channel (PBCH).

[0010] Non-patent literature 3GPP draft, R1-1716524, titled "Remaining details on NR-PBCH", discusses about CORESET transmission configuration and CORESET configuration in NR-PBCH.

[0011] Non-patent literature 3GPP draft, R1-1717952, titled "Discussion on search space design", discusses about CORESET configuration, nested structure and multi-beam operation for NR-PDCCH.

SUMMARY

[0012] The present invention concerns a control information transmission method according to claim 1, a control information detection method according to claim 13, a network device according to claim 14, and a user equipment according to claim 15. An object of the present disclosure is to provide a control information transmission method, a control information detection method, a network device and a UE, so as to map a control resource set to same time-domain resources as a plurality of symbols occupied by SS blocks, thereby to reduce the quantity of time-frequency resources occupied during a beam scanning operation, improve the scheduling flexibility of the UE, and reduce the detection complexity of the UE.

[0013] The present disclosure at least has the following beneficial effects. According to the embodiments of the present disclosure, the control resource set for transmitting the control information may be mapped to the at least one RB adjacent to the RB occupied by the SS block in accordance with the predetermined mapping mode, and then the predetermined mapping mode may be transmitted to the UE and the control information may be trans-

mitted to the UE on the at least one RB occupied by the control resource set. Through mapping the control resource set to a plurality of symbols at the frequency domain adjacent to the SS block, it is able to reduce the quantity of time-frequency resources for the beam scanning operation, thereby to improve the user scheduling flexibility. In addition, it is merely necessary to detect the physical resources occupied by the control resource set, rather than the entire system bandwidth or the sub-band bandwidth, so it is able to simplify the detection complexity of the UE.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a schematic view showing a full bandwidth configuration of a control channel in the related art; FIG. 2 is a schematic view showing a sub-band configuration of the control channel in the related art; FIG. 3 is a flow chart of a control information transmission method according to one embodiment of the present disclosure; FIG. 4 is a schematic view showing a mapping mode 1 of a control resource set according to one embodiment of the present disclosure; FIG. 5 is a schematic view showing a mapping mode 2 of the control resource set according to one embodiment of the present disclosure; and FIG. 6 is a flow chart of a control information detection method according to one embodiment of the present disclosure.

DETAILED DESCRIPTION

[0015] The present disclosure will be described hereinafter in conjunction with the drawings and embodiments. The following embodiments are for illustrative purposes only, but shall not be used to limit the scope of the present disclosure. Actually, the embodiments are provided so as to facilitate the understanding of the scope of the present disclosure.

[0016] As shown in FIG. 3, the present disclosure provides in some embodiments a control information transmission method which includes the following steps.

[0017] Step 31: mapping a control resource set for transmitting control information to at least one RB adjacent to an RB occupied by an SS block in accordance with a predetermined mapping mode. Here, the control resource set may be used for an initial access process of a user or transmit public information (including one of scheduling system information, paging information, power control information or any other public broadcast information). The control resource set may also be called as public control resource set. The term "public control resource set" defined herein is merely used for description, but shall not be used to limit functions of the control resource set.

[0018] Step 32: transmitting the predetermined mapping mode to the UE, and transmitting the control information to the UE on the at least one RB occupied by the control resource set.

[0019] In the embodiments of the present disclosure, Step 31 may include mapping the control resource set for transmitting the control information to at least one RB adjacent to an RB occupied by a PSS in the SS block and to at least one RB adjacent to an RB occupied by a PBCH in the SS block in accordance with the predetermined mapping mode.

[0020] To be specific, the at least one RB adjacent to the RB occupied by the PSS may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS. For example, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PSS may include a first CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a first frequency domain, and a second CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a second frequency domain.

[0021] The at least one RB adjacent to the RB occupied by the PBCH may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH. For example, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PBCH may include a third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a third frequency domain, and a fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a fourth frequency domain. Here, $N=6$. Of course, N may be of any other value. In addition, the description herein merely relates to a size relationship between the frequency in the first frequency domain and the frequency in the second frequency domain, rather than positions of the first frequency domain and the second frequency domain in a mapping pattern.

[0022] The PSS and the PBCH may be located at a same central frequency point and at different time domains, and occupy different bandwidths. The PSS may occupy one OFDM symbol in the time domain, and the PBCH may occupy three OFDM symbols in the time domain. A frequency in the first frequency domain may be greater than a frequency in the frequency domain where the PSS is located, and the frequency in the frequency domain where the PSS is located may be greater than a frequency in the second frequency domain. A frequency in the third frequency domain may be greater than a frequency in the frequency domain where the PBCH is located, and the frequency in the frequency domain where the PBCH is located may be greater than a frequency in the fourth frequency domain.

[0023] A specific design pattern of the control resource set will be described hereinafter in conjunction with the

drawings.

[0024] As shown in FIG. 4, in a 5th-Generation (5G) New Radio (NR) system, the public control resource set may include 24 RBs for the transmission of a common control channel (6 RBs in each of the four CCEs as specified in the 5G system), i.e., 6 RBs at either side of the PSS and 6 RBs at either side of the PBCH (the 6 RBs adjacent to the PSS may occupy one OFDM symbol in the time domain and occupy 6 RBs in the frequency domain, and the 6 RBs adjacent to the PBCH may occupy three OFDM symbols in the time domain and occupy 2 RBs in the frequency domain). In this pattern, each RB may be, for example, a Physical Resource Block (PRB).

[0025] The 24 RBs may be divided into CCE0 (i.e., the first CCE), CCE1 (i.e., the second CCE), CCE2 (i.e., the third CCE), and CCE3 (i.e., the fourth CCE). The serial numbers CCE0 to CCE3 are merely used for illustratively purposes, but shall not be used to limit the scope of the present disclosure. In addition, any other serial numbers may also be applied.

[0026] In this pattern, when a subcarrier spacing is 15kHz, each RB may include 12 subcarriers and have a bandwidth of 180kHz, and the PBCH in the SS block (a Secondary Synchronization Signal (SSS) may occupy 12 RBs in the middle of a central symbol) may occupy 20 RBs in the frequency domain and have a bandwidth of 3.6MHz. When the subcarrier spacing is 30kHz, the PBCH may have a bandwidth of 7.2MHz. In addition, when the subcarrier spacing is of any other value, the bandwidth occupied by the SS block may be extended correspondingly.

[0027] In the embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, and the fourth CCE. During the transmission of the control information, Step 32 may include transmitting the control information on the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set.

[0028] In another possible embodiment of the present disclosure, Step 31 may include mapping the control resource set for transmitting the control information to at least one RB adjacent to the RB occupied by the PSS in the SS block and to at least one RB adjacent to the RB occupied by the PBCH in the SS block in accordance with the predetermined mapping mode.

[0029] To be specific, the at least one RB adjacent to the RB occupied by the PSS may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS. For example, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PSS may include the first CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at the first frequency domain, and the second CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at the second frequency domain.

[0030] The at least one RB adjacent to the RB occupied

by the PBCH may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH. For example, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PBCH may include the third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at the third frequency domain, and the fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at the fourth frequency domain.

[0031] In addition, Step 31 may include mapping the control resource set for transmitting the control information to, in accordance with the predetermined mapping mode, number M1 of adjacent RBs at a same time domain as the first CCE, number M2 of adjacent RBs at a same time domain as the second CCE, number M3 of adjacent RBs at a same time domain as a first OFDM symbol of the third CCE, number M4 of adjacent RBs at a same time domain as a first OFDM symbol of the fourth CCE, number M5 of adjacent RBs at a same time domain as a second OFDM symbol of the third CCE, number M6 of adjacent RBs at a same time domain as a second OFDM symbol of the fourth CCE, number M7 of adjacent RBs at a same time domain as a third OFDM symbol of the third CCE, and number M8 of adjacent RBs at a same time domain as a third OFDM symbol of the fourth CCE. The M1, M3, M5 and M7 RBs may be located at a same frequency domain, i.e., a fifth frequency domain, the numbers of M2, M4, M6 and M8 of RBs may be located at a same frequency domain, i.e., a sixth frequency domain, a frequency in the fifth frequency domain may be greater than the frequency in each of the first frequency domain and the third frequency domain, and a frequency in the sixth frequency domain may be smaller than the frequency in each of the second frequency domain and the fourth frequency domain.

[0032] Here, the description merely relates to a size relationship among the frequencies in the first frequency domain, the second frequency domain, the third frequency domain and the fourth frequency domain, rather than positions of the first frequency domain, the second frequency domain, the third frequency domain and the fourth frequency domain in a mapping pattern.

[0033] In some possible embodiments of the present disclosure, the number of M1 and M3 of RBs may form a fifth CCE, the number of M2 and M4 of RBs may form a sixth CCE, the number of M5 and M7 of RBs may form a seventh CCE, and the number of M6 and M8 of RBs may form an eighth CCE. $N=6$, and $M1=M2=M3=M4=M5=M6=M7=M8=3$.

[0034] Another design pattern of the control resource set will be described hereinafter in conjunction with the drawings.

[0035] As shown in FIG. 5, in the 5G NR system, the public control resource set may include totally 48 RBs (6 RBs in each of the eight CCEs as specified in the 5G system), i.e., 6 RBs at either side of the PSS, 6 RBs at

either side of the PBCH (the 6 RBs adjacent to the PSS may occupy one OFDM symbol in the time domain and occupy 6 RBs in the frequency domain, and the 6 RBs adjacent to the PBCH may occupy three OFDM symbols in the time domain and occupy 2 RBs in the frequency domain), 12 RBs adjacent to the first CCE and the third CCE, and 12 RBs adjacent to the second CCE and the fourth CCE. In this pattern, each RB may be, for example, a PRB.

[0036] The 24 RBs adjacent to the PSS and the PBCH may be divided into CCE0, CCE1, CCE2 and CCE3, and the 24 RBs adjacent to the first CCE, the second CCE, the third CCE and the fourth CCE may be divided into CCE4 (i.e., the fifth CCE), CCE5 (i.e., the sixth CCE), CCE6 (i.e., the seventh CCE), and CCE7 (i.e., the eighth CCE).

[0037] It should be appreciated that, the serial numbers CCE0 to CCE3 and CCE4 to CCE7 are merely used for illustratively purposes, but shall not be used to limit the scope of the present disclosure. In addition, any other serial numbers may also be applied.

[0038] In addition, in this pattern, when a subcarrier spacing is 15kHz, each RB may include 12 subcarriers and have a bandwidth of 180kHz, and the PBCH in the SS block (the SSS may occupy 12 RBs in the middle of a central symbol) may occupy 20 RBs in the frequency domain and have a bandwidth of 3.6MHz. When the subcarrier spacing is 30kHz, the PBCH may have a bandwidth of 7.2MHz. In addition, when the subcarrier spacing is of any other value, the bandwidth occupied by the SS block may be extended correspondingly.

[0039] In the embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE. During the transmission of the control information, Step 32 may include: transmitting the control information on the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set; and/or transmitting the control information on the RBs occupied by the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE in the control resource set.

[0040] In some possible embodiments of the present disclosure, on the basis of Steps 31 and 32, the control information transmission method may further include Step 33 of transmitting a multiplexing mode of the control resource set and the SS block to the UE, and the multiplexing mode may include time-division multiplexing or frequency-division multiplexing.

[0041] To be specific, the multiplexing mode of the control resource set and the SS block may be transmitted to the UE through semi-static indication. The semi-static indication may include indicating the PBCH through one bit, or Radio Resource Control (RRC) signaling configuration.

[0042] According to the embodiments of the present

disclosure, the control resource set for transmitting the control information may be mapped to the at least one RB adjacent to the RB occupied by the SS block in accordance with the predetermined mapping mode, and then the predetermined mapping mode may be transmitted to the UE and the control information may be transmitted to the UE on the at least one RB occupied by the control resource set. Through mapping the control resource set to a plurality of symbols at the frequency domain adjacent to the SS block, it is able to reduce the quantity of time-frequency resources for the beam scanning operation. In addition, it is merely necessary to detect the physical resources occupied by the control resource set, rather than the entire system bandwidth or the sub-band bandwidth, so it is able to simplify the detection complexity of the UE.

[0043] In addition, the multiplexing mode of the control resource set may be transmitted to the UE, and the multiplexing mode may include the time-division multiplexing or the frequency-division multiplexing. In this way, it is able to improve the user scheduling flexibility.

[0044] As shown in FIG. 6, the present disclosure further provides in some embodiments a control information detection method which includes: Step 61 of receiving a predetermined mapping mode from a network device, the predetermined mapping mode being a mapping mode in which a control resource set for transmitting control information is mapped by the network device to at least one RB adjacent to an RB occupied by an SS block; and Step 62 of detecting the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode.

[0045] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the SS block may include at least one RB adjacent to an RB occupied by a PSS in the SS block and at least one RB adjacent to an RB occupied by a PBCH in the SS block.

[0046] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the PSS may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS, and the at least one RB adjacent to the RB occupied by the PBCH may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

[0047] In some possible embodiments of the present disclosure, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PSS may include a first Control Channel Element (CCE) consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a first frequency domain, and a second CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a second frequency domain. The at least one RB at the same time domain as, and at the different frequency domain from, the RB oc-

occupied by the PBCH may include a third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a third frequency domain, and a fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a fourth frequency domain.

[0048] In some possible embodiments of the present disclosure, the PSS and the PBCH may be located at a same central frequency point and at different time domains, and occupy different bandwidths. The PSS may occupy one OFDM symbol in the time domain, and the PBCH may occupy three OFDM symbols in the time domain. A frequency in the first frequency domain may be greater than a frequency in the frequency domain where the PSS is located, and the frequency in the frequency domain where the PSS is located may be greater than a frequency in the second frequency domain. A frequency in the third frequency domain may be greater than a frequency in the frequency domain where the PBCH is located, and the frequency in the frequency domain where the PBCH is located may be greater than a frequency in the fourth frequency domain.

[0049] In some possible embodiments of the present disclosure, N=6.

[0050] In some possible embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, and the fourth CCE. The detecting the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode may include detecting the control information transmitted through the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set in accordance with the predetermined mapping mode.

[0051] In some possible embodiments of the present disclosure, referring to the mapping mode in FIG. 4, during the detection of the control information, the UE may detect the control resource set corresponding to CCE0 to CCE3, i.e., directly detect the 24 RBs corresponding to the control resource set.

[0052] In another possible embodiment of the present disclosure, the at least one RB adjacent to the RB occupied by the SS block may include at least one RB adjacent to an RB occupied by a PSS in the SS block and at least one RB adjacent to an RB occupied by a PBCH in the SS block.

[0053] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the PSS may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS, and the at least one RB adjacent to the RB occupied by the PBCH may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

[0054] In some possible embodiments of the present disclosure, the at least one RB at the same time domain as, and at the different frequency domain from, the RB

occupied by the PSS may include a first CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a first frequency domain, and a second CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a second frequency domain. The at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PBCH may include a third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a third frequency domain, and a fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a fourth frequency domain.

[0055] In some possible embodiments of the present disclosure, the PSS and the PBCH may be located at a same central frequency point and at different time domains, and occupy different bandwidths. The PSS may occupy one OFDM symbol in the time domain, and the PBCH may occupy three OFDM symbols in the time domain. A frequency in the first frequency domain may be greater than a frequency in the frequency domain where the PSS is located, and the frequency in the frequency domain where the PSS is located may be greater than a frequency in the second frequency domain. A frequency in the third frequency domain may be greater than a frequency in the frequency domain where the PBCH is located, and the frequency in the frequency domain where the PBCH is located may be greater than a frequency in the fourth frequency domain.

[0056] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the PBCH in the SS block may further include: number M1 of adjacent RBs at a same time domain as the first CCE, number M2 of adjacent RBs at a same time domain as the second CCE, number M3 of adjacent RBs at a same time domain as a first OFDM symbol of the third CCE, number M4 of adjacent RBs at a same time domain as a first OFDM symbol of the fourth CCE, number M5 of adjacent RBs at a same time domain as a second OFDM symbol of the third CCE, number M6 of adjacent RBs at a same time domain as a second OFDM symbol of the fourth CCE, number M7 of adjacent RBs at a same time domain as a third OFDM symbol of the third CCE, and number M8 of adjacent RBs at a same time domain as a third OFDM symbol of the fourth CCE. The M1, M3, M5 and M7 RBs may be located at a same frequency domain, i.e., a fifth frequency domain, the numbers of M2, M4, M6 and M8 of RBs may be located at a same frequency domain, i.e., a sixth frequency domain, a frequency in the fifth frequency domain may be greater than the frequency in each of the first frequency domain and the third frequency domain, and a frequency in the sixth frequency domain may be smaller than the frequency in each of the second frequency domain and the fourth frequency domain.

[0057] In some possible embodiments of the present disclosure, the number of M1 and M3 of RBs may form

a fifth CCE, the number of M2 and M4 of RBs may form a sixth CCE, the number of M5 and M7 of RBs may form a seventh CCE, and the number of M6 and M8 of RBs may form an eighth CCE.

[0058] In some possible embodiments of the present disclosure, $M1=M2=M3=M4=M5=M6=M7=M8=3$.

[0059] In some possible embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE. The detecting the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode may include: detecting the control information transmitted through the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set in accordance with the predetermined mapping mode; and/or detecting the control information transmitted through the RBs occupied by the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE in the control resource set in accordance with the predetermined mapping mode.

[0060] To be specific, the UE may detect the 24 RBs corresponding to CCE0 to CCE3, detect the 24 RBs corresponding to CCE0 to CCE7, and perform blind detection on CCE0 to CCE3 and CCE0 to CCE7 sequentially.

[0061] In some possible embodiments of the present disclosure, the control information detection method may further include Step 63 of receiving a multiplexing mode of the control resource set and the SS block from the network device, and the multiplexing mode may include time-division multiplexing or frequency-division multiplexing.

[0062] In some possible embodiments of the present disclosure, the receiving the multiplexing mode of the control resource set and the SS block from the network device may include receiving the multiplexing mode of the control resource set and the SS block from the network device through semi-static indication.

[0063] According to the embodiments of the present disclosure, the control resource set for transmitting the control information may be mapped to the at least one RB adjacent to the RB occupied by the SS block in accordance with the predetermined mapping mode, and then the predetermined mapping mode may be transmitted to the UE and the control information may be transmitted to the UE on the at least one RB occupied by the control resource set. Through mapping the control resource set to a plurality of symbols at the frequency domain adjacent to the SS block, it is able to reduce the quantity of time-frequency resources for the beam scanning operation. In addition, it is merely necessary to detect the physical resources occupied by the control resource set, rather than the entire system bandwidth or the sub-band bandwidth, so it is able to simplify the detection complexity of the UE.

[0064] In addition, the multiplexing mode of the control

resource set may be transmitted to the UE, and the multiplexing mode may include the time-division multiplexing or the frequency-division multiplexing. In this way, it is able to improve the user scheduling flexibility.

[0065] The present disclosure further provides in some embodiments a network device, which includes: a processor configured to map a control resource set for transmitting control information to at least one RB adjacent to an RB occupied by an SS block in accordance with a predetermined mapping mode; and a transceiver configured to transmit the predetermined mapping mode to the UE, and transmit the control information to the UE on the at least one RB occupied by the control resource set.

[0066] In some possible embodiments of the present disclosure, the processor is further configured to map the control resource set for transmitting the control information to at least one RB adjacent to an RB occupied by a PSS in the SS block and to at least one RB adjacent to an RB occupied by a PBCH in the SS block in accordance with the predetermined mapping mode.

[0067] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the PSS may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS, and the at least one RB adjacent to the RB occupied by the PBCH may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

[0068] In some possible embodiments of the present disclosure, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PSS may include a first CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a first frequency domain, and a second CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a second frequency domain. The at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PBCH may include a third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a third frequency domain, and a fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a fourth frequency domain.

[0069] In some possible embodiments of the present disclosure, the PSS and the PBCH may be located at a same central frequency point and at different time domains, and occupy different bandwidths. The PSS may occupy one OFDM symbol in the time domain, and the PBCH may occupy three OFDM symbols in the time domain. A frequency in the first frequency domain may be greater than a frequency in the frequency domain where the PSS is located, and the frequency in the frequency domain where the PSS is located may be greater than a frequency in the second frequency domain. A frequency in the third frequency domain may be greater than a fre-

quency in the frequency domain where the PBCH is located, and the frequency in the frequency domain where the PBCH is located may be greater than a frequency in the fourth frequency domain.

[0070] In some possible embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, and the fourth CCE. The transceiver is further configured to transmit the control information on the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set.

[0071] In some possible embodiments of the present disclosure, the processor is further configured to map the control resource set for transmitting the control information to, in accordance with the predetermined mapping mode, number M1 of adjacent RBs at a same time domain as the first CCE, number M2 of adjacent RBs at a same time domain as the second CCE, number M3 of adjacent RBs at a same time domain as a first OFDM symbol of the third CCE, number M4 of adjacent RBs at a same time domain as a first OFDM symbol of the fourth CCE, number M5 of adjacent RBs at a same time domain as a second OFDM symbol of the third CCE, number M6 of adjacent RBs at a same time domain as a second OFDM symbol of the fourth CCE, number M7 of adjacent RBs at a same time domain as a third OFDM symbol of the third CCE, and number M8 of adjacent RBs at a same time domain as a third OFDM symbol of the fourth CCE. The M1, M3, M5 and M7 RBs may be located at a same frequency domain, i.e., a fifth frequency domain, the numbers of M2, M4, M6 and M8 of RBs may be located at a same frequency domain, i.e., a sixth frequency domain, a frequency in the fifth frequency domain may be greater than the frequency in each of the first frequency domain and the third frequency domain, and a frequency in the sixth frequency domain may be smaller than the frequency in each of the second frequency domain and the fourth frequency domain.

[0072] In some possible embodiments of the present disclosure, the number of M1 and M3 of RBs may form a fifth CCE, the number of M2 and M4 of RBs may form a sixth CCE, the number of M5 and M7 of RBs may form a seventh CCE, and the number of M6 and M8 of RBs may form an eighth CCE.

[0073] In some possible embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE. The transceiver is further configured to: transmit the control information on the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set; and/or transmit the control information on the RBs occupied by the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE in the control resource set.

[0074] In some possible embodiments of the present disclosure, the transceiver is further configured to trans-

mit a multiplexing mode of the control resource set and the SS block to the UE, and the multiplexing mode may include time-division multiplexing or frequency-division multiplexing.

[0075] It should be appreciated that, the network side device may be a base station, and the implementation of the network device may refer to that of the method in FIG. 3 with a same technical effect.

[0076] The present disclosure further provides in some embodiments a UE, which includes a transceiver configured to: receive a predetermined mapping mode from a network device, the predetermined mapping mode being a mapping mode in which a control resource set for transmitting control information is mapped by the network device to at least one RB adjacent to an RB occupied by an SS block; and detect the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode.

[0077] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the SS block may include at least one RB adjacent to an RB occupied by a PSS in the SS block and at least one RB adjacent to an RB occupied by a PBCH in the SS block.

[0078] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the PSS may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS, and the at least one RB adjacent to the RB occupied by the PBCH may include at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

[0079] In some possible embodiments of the present disclosure, the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PSS may include a first CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a first frequency domain, and a second CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a second frequency domain. The at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PBCH may include a third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a third frequency domain, and a fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a fourth frequency domain.

[0080] In some possible embodiments of the present disclosure, the PSS and the PBCH may be located at a same central frequency point and at different time domains, and occupy different bandwidths. The PSS may occupy one OFDM symbol in the time domain, and the PBCH may occupy three OFDM symbols in the time domain. A frequency in the first frequency domain may be greater than a frequency in the frequency domain where

the PSS is located, and the frequency in the frequency domain where the PSS is located may be greater than a frequency in the second frequency domain. A frequency in the third frequency domain may be greater than a frequency in the frequency domain where the PBCH is located, and the frequency in the frequency domain where the PBCH is located may be greater than a frequency in the fourth frequency domain.

[0081] In some possible embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, and the fourth CCE. When detecting the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode, the transceiver is further configured to detect the control information transmitted through the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set in accordance with the predetermined mapping mode.

[0082] In some possible embodiments of the present disclosure, the at least one RB adjacent to the RB occupied by the SS block may further include: number M1 of adjacent RBs at a same time domain as the first CCE, number M2 of adjacent RBs at a same time domain as the second CCE, number M3 of adjacent RBs at a same time domain as a first OFDM symbol of the third CCE, number M4 of adjacent RBs at a same time domain as a first OFDM symbol of the fourth CCE, number M5 of adjacent RBs at a same time domain as a second OFDM symbol of the third CCE, number M6 of adjacent RBs at a same time domain as a second OFDM symbol of the fourth CCE, number M7 of adjacent RBs at a same time domain as a third OFDM symbol of the third CCE, and number M8 of adjacent RBs at a same time domain as a third OFDM symbol of the fourth CCE. The M1, M3, M5 and M7 RBs may be located at a same frequency domain, i.e., a fifth frequency domain, the numbers of M2, M4, M6 and M8 of RBs may be located at a same frequency domain, i.e., a sixth frequency domain, a frequency in the fifth frequency domain may be greater than the frequency in each of the first frequency domain and the third frequency domain, and a frequency in the sixth frequency domain may be smaller than the frequency in each of the second frequency domain and the fourth frequency domain.

[0083] In some possible embodiments of the present disclosure, the number of M1 and M3 of RBs may form a fifth CCE, the number of M2 and M4 of RBs may form a sixth CCE, the number of M5 and M7 of RBs may form a seventh CCE, and the number of M6 and M8 of RBs may form an eighth CCE.

[0084] In some possible embodiments of the present disclosure, the control resource set may include the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE. When detecting the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode,

the transceiver is further configured to: detect the control information transmitted through the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set in accordance with the predetermined mapping mode; and/or detect the control information transmitted through the RBs occupied by the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE in the control resource set in accordance with the predetermined mapping mode.

[0085] In some possible embodiments of the present disclosure, the transceiver is further configured to receive a multiplexing mode of the control resource set and the SS block from the network device, and the multiplexing mode may include time-division multiplexing or frequency-division multiplexing.

[0086] It should be appreciated that, the implementation of the UE may refer to that of the method shown in FIG. 6 with a same technical effect.

[0087] The present disclosure further provides in some embodiments a communication device, including a processor, and a memory storing therein a computer program. The processor is configured to execute the computer program so as to implement the above-mentioned methods. The processor may communicate with the memory via a bus or an interface. The communication device may be the above-mentioned network device or the above-mentioned UE.

[0088] The present disclosure further provides in some embodiments a computer-readable storage medium storing therein an instruction. The instruction is executed by a computer so as to implement the above-mentioned methods.

[0089] According to the embodiments of the present disclosure, the control resource set for transmitting the control information may be mapped to the at least one RB adjacent to the RB occupied by the SS block in accordance with the predetermined mapping mode, and then the predetermined mapping mode may be transmitted to the UE and the control information may be transmitted to the UE on the at least one RB occupied by the control resource set. Through mapping the control resource set to a plurality of symbols at the frequency domain adjacent to the SS block, it is able to reduce the quantity of time-frequency resources for the beam scanning operation. In addition, it is merely necessary to detect the physical resources occupied by the control resource set, rather than the entire system bandwidth or the sub-band bandwidth, so it is able to simplify the detection complexity of the UE. Furthermore, the control resource set and the SS block may be multiplexed in a frequency-division manner, thereby to improve the user scheduling flexibility.

[0090] The above embodiments are for illustrative purposes only, but the present disclosure is not limited thereto.

Claims

1. A control information transmission method performed by a network device, comprising:

mapping (31) a control resource set for transmitting control information to at least one Resource Block, RB, adjacent to an RB occupied by a Synchronization Signal, SS, block in accordance with a predetermined mapping mode; and

transmitting (32) the predetermined mapping mode to a User Equipment, UE, and transmitting the control information to the UE on the at least one RB occupied by the control resource set, the control information transmission method being **characterized in that**

the mapping (31) the control resource set for transmitting the control information to at least one RB adjacent to the RB occupied by the SS block in accordance with the predetermined mapping mode comprises: mapping the control resource set for transmitting the control information to at least one RB adjacent to an RB occupied by a Physical Broadcast Channel, PBCH, in the SS block in accordance with the predetermined mapping mode; and

the at least one RB adjacent to the RB occupied by the PBCH comprises at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

2. The control information transmission method according to claim 1, wherein the mapping (31) the control resource set for transmitting the control information to at least one RB adjacent to the RB occupied by the SS block in accordance with the predetermined mapping mode further comprises: mapping the control resource set for transmitting the control information to at least one RB adjacent to an RB occupied by a Primary Synchronization Signal, PSS, in the SS block.

3. The control information transmission method according to claim 2, wherein the at least one RB adjacent to the RB occupied by the PSS further comprises at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PSS.

4. The control information transmission method according to claim 3, wherein the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PSS comprises a first Control Channel Element, CCE, consisting of N consecutive RBs at the same time domain as the RB occupied by the PSS and at a first frequency domain, and a second CCE consisting of

N consecutive RBs at the same time domain as the RB occupied by the PSS and at a second frequency domain,

wherein the at least one RB at the same time domain as, and at the different frequency domain from, the RB occupied by the PBCH comprises a third CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a third frequency domain, and a fourth CCE consisting of N consecutive RBs at the same time domain as the RB occupied by the PBCH and at a fourth frequency domain,

wherein the PSS and the PBCH are located at a same central frequency point and at different time domains, and occupy different bandwidths, the PSS occupies one Orthogonal Frequency Division Multiplexing, OFDM, symbol in the time domain, and the PBCH occupies three OFDM symbols in the time domain,

wherein a frequency in the first frequency domain is greater than a frequency in the frequency domain where the PSS is located, the frequency in the frequency domain where the PSS is located is greater than a frequency in the second frequency domain, a frequency in the third frequency domain is greater than a frequency in the frequency domain where the PBCH is located, and the frequency in the frequency domain where the PBCH is located is greater than a frequency in the fourth frequency domain.

5. The control information transmission method according to claim 4, wherein N=6.

6. The control information transmission method according to claim 4, wherein the control resource set comprises the first CCE, the second CCE, the third CCE, and the fourth CCE, wherein the transmitting the control information on the at least one RB occupied by the control resource set comprises transmitting the control information on the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set.

7. The control information transmission method according to claim 5, further comprising: mapping the control resource set for transmitting the control information to, in accordance with the predetermined mapping mode, number M1 of adjacent RBs at a same time domain as the first CCE, number M2 of adjacent RBs at a same time domain as the second CCE, number M3 of adjacent RBs at a same time domain as a first OFDM symbol of the third CCE, number M4 of adjacent RBs at a same time domain as a first OFDM symbol of the fourth CCE, number M5 of adjacent RBs at a same time domain as a

second OFDM symbol of the third CCE, number M6 of adjacent RBs at a same time domain as a second OFDM symbol of the fourth CCE, number M7 of adjacent RBs at a same time domain as a third OFDM symbol of the third CCE, and number M8 of adjacent RBs at a same time domain as a third OFDM symbol of the fourth CCE, wherein the numbers of M1, M3, M5 and M7 of RBs are located at a same fifth frequency domain, the numbers of M2, M4, M6 and M8 of RBs are located at a same sixth frequency domain, a frequency in the fifth frequency domain is greater than the frequency in each of the first frequency domain and the third frequency domain, and a frequency in the sixth frequency domain is smaller than the frequency in each of the second frequency domain and the fourth frequency domain.

8. The control information transmission method according to claim 7, wherein the number of M1 and M3 of RBs form a fifth CCE, the number of M2 and M4 of RBs form a sixth CCE, the number of M5 and M7 of RBs form a seventh CCE, and the number of M6 and M8 of RBs form an eighth CCE.

9. The control information transmission method according to claim 8, wherein M1=M2=M3=M4=M5=M6=M7=M8=3.

10. The control information transmission method according to claim 7, wherein the control resource set comprises the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE, wherein the transmitting the control information on the at least one RB occupied by the control resource set comprises:

transmitting the control information on the RBs occupied by the first CCE, the second CCE, the third CCE and the fourth CCE in the control resource set; and/or

transmitting the control information on the RBs occupied by the first CCE, the second CCE, the third CCE, the fourth CCE, the fifth CCE, the sixth CCE, the seventh CCE and the eighth CCE in the control resource set.

11. The control information transmission method according to claim 1, further comprising: transmitting (33) a multiplexing mode of the control resource set and the SS block to the UE, wherein the multiplexing mode comprises time-division multiplexing or frequency-division multiplexing.

12. The control information transmission method according to claim 11, wherein the transmitting (33) the multiplexing mode of the control resource set and the SS block to the UE comprises:

transmitting the multiplexing mode of the control resource set and the SS block to the UE through semi-static indication.

13. A control information detection method performed by a User Equipment, UE, comprising:

receiving (61) a predetermined mapping mode from a network device, the predetermined mapping mode being a mapping mode in which a control resource set for transmitting control information is mapped by the network device to at least one Resource Block, RB, adjacent to an RB occupied by a Synchronization Signal, SS, block; and

detecting (62) the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode,

the control information detection method being **characterized in that**

the at least one RB adjacent to the RB occupied by the SS block comprises at least one RB adjacent to an RB occupied by a Physical Broadcast Channel, PBCH, in the SS block; and the at least one RB adjacent to the RB occupied by the PBCH comprises at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

14. A network device, comprising:

a processor configured to map (31) a control resource set for transmitting control information to at least one Resource Block, RB, adjacent to an RB occupied by a Synchronization Signal, SS, block in accordance with a predetermined mapping mode; and

a transceiver configured to transmit (32) the predetermined mapping mode to the UE, and transmit the control information to the UE on the at least one RB occupied by the control resource set,

the network device being **characterized in that** the processor is further configured to: map the control resource set for transmitting the control information to at least one RB adjacent to an RB occupied by a Physical Broadcast Channel, PBCH, in the SS block in accordance with the predetermined mapping mode; and the at least one RB adjacent to the RB occupied by the PBCH comprises at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

15. A User Equipment, UE, comprising a transceiver configured to: receive (61) a predetermined mapping mode from a network device, the predetermined

mapping mode being a mapping mode in which a control resource set for transmitting control information is mapped by the network device to at least one Resource Block, RB, adjacent to an RB occupied by a Synchronization Signal, SS, block; and detect (62) the control information on the at least one RB occupied by the control resource set in accordance with the predetermined mapping mode,

the UE being **characterized in that**

the at least one RB adjacent to the RB occupied by the SS block comprises at least one RB adjacent to an RB occupied by a Physical Broadcast Channel, PBCH, in the SS block; and the at least one RB adjacent to the RB occupied by the PBCH comprises at least one RB at a same time domain as, and at a different frequency domain from, the RB occupied by the PBCH.

Patentansprüche

1. Verfahren zum Senden von Steuerinformationen, das von einer Netzwerkvorrichtung durchgeführt wird und umfasst:

Abbilden (31) eines Steuerressourcensatzes zum Senden von Steuerinformationen auf mindestens einen Ressourcenblock, RB, der an einen von einem Synchronisationssignalblock, SS, belegten RB angrenzt, in Übereinstimmung mit einem vorbestimmten Abbildungsmodus; und

Senden (32) des vorbestimmten Abbildungsmodus an ein Benutzergerät, UE, und Senden der Steuerinformationen an das UE auf dem mindestens einen RB, der von der Steuerressourcengruppe belegt ist,

das Verfahren zum Senden von Steuerinformationen ist **dadurch gekennzeichnet, dass** das Abbilden (31) des Steuerressourcensatzes zum Senden der Steuerinformationen auf mindestens einen RB, der an den von dem SS-Block belegten RB angrenzt, gemäß dem vorbestimmten Abbildungsmodus umfasst: Abbilden des Steuerressourcensatzes zum Senden der Steuerinformationen auf mindestens einen RB, der an einen RB angrenzt, der von einem Physical Broadcast Channel, PBCH, in dem SS-Block belegt ist, gemäß dem vorbestimmten Abbildungsmodus; und

die mindestens eine RB, die an die von der PBCH belegte RB angrenzt, mindestens eine RB in einem gleichen Zeitbereich wie die von der PBCH belegte RB und in einem anderen Frequenzbereich als diese umfasst.

2. Verfahren zum Senden von Steuerinformationen ge-

mäß Anspruch 1, wobei das Abbilden (31) des Steuerressourcensatzes zum Senden der Steuerinformationen an mindestens einen RB, der an den vom SS-Block belegten RB angrenzt, gemäß dem vorbestimmten Abbildungsmodus ferner umfasst:

Abbilden des Steuerressourcensatzes zum Senden der Steuerinformationen auf mindestens einen RB, der an einen RB angrenzt, der durch ein Primärsynchronisationssignal, PSS, im SS-Block belegt ist.

3. Verfahren zum Senden von Steuerinformationen nach Anspruch 2, wobei der mindestens eine RB, der an den von der PSS belegten RB angrenzt, ferner mindestens einen RB umfasst, der sich in demselben Zeitbereich wie der von der PSS belegte RB und in einem davon verschiedenen Frequenzbereich befindet.

4. Verfahren zum Senden von Steuerinformationen nach Anspruch 3, wobei der mindestens eine RB im gleichen Zeitbereich wie der von der PSS belegte RB und in einem anderen Frequenzbereich als dieser ein erstes Steuerkanalelement, CCE, umfasst, das aus N aufeinanderfolgenden RB im gleichen Zeitbereich wie der von der PSS belegte RB und in einem ersten Frequenzbereich besteht, und ein zweites CCE, das aus N aufeinanderfolgenden RB im gleichen Zeitbereich wie der von der PSS belegte RB und in einem zweiten Frequenzbereich besteht,

wobei die mindestens eine RB im gleichen Zeitbereich wie die von der PBCH belegte RB und in einem anderen Frequenzbereich als diese, eine dritte CCE umfasst, die aus N aufeinanderfolgenden RB im gleichen Zeitbereich wie die von der PBCH belegte RB und in einem dritten Frequenzbereich besteht, und eine vierte CCE, die aus N aufeinanderfolgenden RB im gleichen Zeitbereich wie die von der PBCH belegte RB und in einem vierten Frequenzbereich besteht, wobei sich die PSS und die PBCH an einem gleichen zentralen Frequenzpunkt und in unterschiedlichen Zeitbereichen befinden und unterschiedliche Bandbreiten belegen, die PSS ein OFDM, Orthogonal Frequency Division Multiplexing, -Symbol im Zeitbereich belegt und die PBCH drei OFDM-Symbole im Zeitbereich belegt,

wobei eine Frequenz in der ersten Frequenzdomäne größer ist als eine Frequenz in der Frequenzdomäne, in der sich der PSS befindet, die Frequenz in der Frequenzdomäne, in der sich der PSS befindet, größer ist als eine Frequenz in der zweiten Frequenzdomäne, eine Frequenz in der dritten Frequenzdomäne größer ist als eine Frequenz in der Frequenzdomäne, in der sich der PBCH befindet, und die Frequenz in der Frequenzdomäne, in der sich der PBCH befindet,

größer ist als eine Frequenz in der vierten Frequenzdomäne.

5. Verfahren zum Senden von Steuerinformationen nach Anspruch 4, wobei $N=6$. 5
6. Verfahren zum Senden von Steuerinformationen nach Anspruch 4, wobei die Steuereinheit die erste CCE, die zweite CCE, die dritte CCE und die vierte CCE umfasst, wobei das Senden der Steuerinformationen auf dem mindestens einen von der Steuereinheit belegten RB das Senden der Steuerinformationen auf den RBs umfasst, die von der ersten CCE, der zweiten CCE, der dritten CCE und der vierten CCE in der Steuereinheit belegt sind. 10 15
7. Verfahren zum Senden von Steuerinformationen nach Anspruch 5, ferner umfassend:
Abbilden des Steuerressourcensatzes zum Senden der Steuerinformationen gemäß dem vorbestimmten Abbildungsmodus auf eine Anzahl M1 von benachbarten RBs in einer gleichen Zeitdomäne wie die erste CCE, eine Anzahl M2 von benachbarten RBs in einer gleichen Zeitdomäne wie die zweite CCE, eine Anzahl M3 von benachbarten RBs in einer gleichen Zeitdomäne wie ein erstes OFDM-Symbol der dritten CCE Anzahl M4 von benachbarten RBs in einem gleichen Zeitbereich wie ein erstes OFDM-Symbol des vierten CCE, Anzahl M5 von benachbarten RBs in einem gleichen Zeitbereich wie ein zweites OFDM-Symbol des dritten CCE, Anzahl M6 von benachbarten RBs in einem gleichen Zeitbereich wie ein zweites OFDM-Symbol des vierten CCE, Anzahl M7 von benachbarten RBs in einer gleichen Zeitdomäne wie ein drittes OFDM-Symbol des dritten CCE, und Anzahl M8 von benachbarten RBs in einer gleichen Zeitdomäne wie ein drittes OFDM-Symbol des vierten CCE, wobei die Anzahlen M1, M3, M5 und M7 von RBs in einer gleichen fünften Frequenzdomäne liegen, die Anzahlen M2, M4, M6 und M8 von RBs sich in derselben sechsten Frequenzdomäne befinden, eine Frequenz in der fünften Frequenzdomäne größer ist als die Frequenz in jeder der ersten Frequenzdomäne und der dritten Frequenzdomäne, und eine Frequenz in der sechsten Frequenzdomäne kleiner ist als die Frequenz in jeder der zweiten Frequenzdomäne und der vierten Frequenzdomäne. 20 25 30 35 40 45
8. Verfahren zum Senden von Steuerinformationen nach Anspruch 7, wobei die Anzahl von M1 und M3 von RBs eine fünfte CCE bilden, die Anzahl von M2 und M4 von RBs eine sechste CCE bilden, die Anzahl von M5 und M7 von RBs eine siebte CCE bilden und die Anzahl von M6 und M8 von RBs eine achte CCE bilden. 50 55
9. Verfahren zum Senden von Steuerinformationen

nach Anspruch 8, wobei $M1 = M2=M3=M4=M5 = M6 = M7=M8=3$.

10. Verfahren zum Senden von Steuerinformationen nach Anspruch 7, wobei der Steuerressourcensatz die erste CCE, die zweite CCE, die dritte CCE, die vierte CCE, die fünfte CCE, die sechste CCE, die siebte CCE und die achte CCE umfasst, wobei das Senden der Steuerinformationen auf dem mindestens einen RB, der von der Steuerressourcengruppe belegt wird, umfasst:

Senden der Steuerinformationen auf den RBs, die von der ersten CCE, der zweiten CCE, der dritten CCE und der vierten CCE in der Steuerressourcengruppe belegt sind; und/oder
Senden der Steuerinformationen auf den RBs, die von der ersten CCE, der zweiten CCE, der dritten CCE, der vierten CCE, der fünften CCE, der sechsten CCE, der siebten CCE und der achten CCE in der Steuerressourcengruppe belegt werden. 5 10 15
11. Verfahren zum Senden von Steuerinformationen gemäß Anspruch 1 ferner umfassen:
Senden (33) eines Multiplexing-Modus des Steuerressourcensatzes und des SS-Blocks an das UE, wobei der Multiplexing-Modus Zeitmultiplexing oder Frequenzmultiplexing umfasst. 25 30
12. Verfahren zum Senden von Steuerinformationen nach Anspruch 11, wobei das Senden (33) des Multiplexing-Modus des Steuerressourcensatzes und des SS-Blocks an das UE umfasst:
Senden des Multiplexing-Modus des Steuerressourcensatzes und des SS-Blocks an das UE durch semistatische Anzeige. 35 40
13. Verfahren zum Erkennen von Steuerinformationen, das von einem Benutzergerät, UE, durchgeführt wird und umfasst:

Empfangen (61) eines vorbestimmten Abbildungsmodus von einer Netzwerkvorrichtung, wobei der vorbestimmte Abbildungsmodus ein Abbildungsmodus ist, in dem ein Steuerressourcensatz zum Senden von Steuerinformationen von der Netzwerkvorrichtung auf mindestens einen Ressourcenblock, RB, abgebildet wird, der an einen von einem Synchronisationssignalkblock, SS, belegten RB angrenzt; und
Erfassen (62) der Steuerinformationen über den mindestens einen RB, der von der Steuerressource gemäß dem vorbestimmten Abbildungsmodus belegt wird,
das Verfahren zum Erfassen von Steuerinformationen ist **dadurch gekennzeichnet, dass** der mindestens eine RB, der an den von dem 45 50 55

SS-Block belegten RB angrenzt, mindestens einen RB umfasst, der an einen RB angrenzt, der von einem Physical Broadcast Channel, PBCH, in dem SS-Block belegt ist; und
 die mindestens eine RB, die an die von der PBCH belegte RB angrenzt, mindestens eine RB in einem gleichen Zeitbereich wie die von der PBCH belegte RB und in einem anderen Frequenzbereich als diese umfasst.

14. Netzwerkvorrichtung, die umfasst:

einen Prozessor, der so konfiguriert ist, dass er einen Steuerressourcensatz zum Senden von Steuerinformationen auf mindestens einen Ressourcenblock, RB, der an einen von einem Synchronisationssignalblock, SS, belegten RB angrenzt, in Übereinstimmung mit einem vorbestimmten Abbildungsmodus abbildet (31); und einen Transceiver, der so konfiguriert ist, dass er den vorbestimmten Abbildungsmodus an das UE sendet (32) und die Steuerinformationen an das UE auf dem mindestens einen RB, der von dem Steuerressourcensatz belegt ist, sendet, die Vorrichtung für das Netzwerk ist **dadurch gekennzeichnet, dass**
 der Prozessor ferner so konfiguriert ist, dass er: den Steuerressourcensatz zum Senden der Steuerinformationen auf mindestens einen RB abbildet, der an einen RB angrenzt, der von einem Physical Broadcast Channel, PBCH, in dem SS-Block in Übereinstimmung mit dem vorbestimmten Abbildungsmodus belegt ist; und die mindestens eine RB, die an die von der PBCH belegte RB angrenzt, mindestens eine RB in einem gleichen Zeitbereich wie die von der PBCH belegte RB und in einem anderen Frequenzbereich als diese umfasst.

15. Benutzergerät, UE, das einen Transceiver umfasst, der konfiguriert ist, um: einen vorbestimmten Abbildungsmodus von einer Vorrichtung des Netzwerks zu empfangen (61), wobei der vorbestimmte Abbildungsmodus ein Abbildungsmodus ist, in dem ein Steuerressourcensatz zum Senden von Steuerinformationen von der Vorrichtung des Netzwerks auf mindestens einen Ressourcenblock, RB, abgebildet wird, der an einen RB angrenzt, der von einem Synchronisationssignalblock, SS, belegt ist; und die Steuerinformationen auf dem mindestens einen RB zu erfassen (62), der von dem Steuerressourcensatz in Übereinstimmung mit dem vorbestimmten Abbildungsmodus belegt ist,

die UE **dadurch gekennzeichnet ist, dass**
 der mindestens eine RB, der an den von dem SS-Block belegten RB angrenzt, mindestens einen RB umfasst, der an einen RB angrenzt, der

von einem Physical Broadcast Channel, PBCH, in dem SS-Block belegt ist; und
 die mindestens eine RB, die an die von der PBCH belegte RB angrenzt, mindestens eine RB in einem gleichen Zeitbereich wie die von der PBCH belegte RB und in einem anderen Frequenzbereich als diese umfasst.

10 Revendications

1. Procédé de transmission d'informations de commande exécuté par un dispositif de réseau, comprenant:

le mappage (31) d'un ensemble de ressources de commande pour transmettre des informations de commande à au moins un bloc de ressources, RB, adjacent à un RB occupé par un bloc de signaux de synchronisation, SS, conformément à un mode de mappage prédéterminé; et

la transmission (32) du mode de mappage prédéterminé à un équipement d'utilisateur, UE, et la transmission des informations de commande à l'UE sur au moins un RB occupé par l'ensemble de ressources de commande,

le procédé de transmission d'informations de commande étant **caractérisé en ce que**

le mappage (31) de l'ensemble de ressources de commande pour la transmission des informations de commande à au moins un RB adjacent au RB occupé par le bloc SS conformément au mode de mappage prédéterminé comprend: le mappage de l'ensemble de ressources de commande pour la transmission des informations de commande à au moins un RB adjacent à un RB occupé par un canal physique de diffusion, PBCH, dans le bloc SS conformément au mode de mappage prédéterminé; et

le au moins un RB adjacent au RB occupé par le PBCH comprend au moins un RB dans le même domaine temporel, et dans un domaine fréquentiel différent de celui-ci, que le RB occupé par le PBCH.

2. Procédé de transmission d'informations de commande selon la revendication 1, dans lequel le mappage (31) de l'ensemble de ressources de commande pour la transmission des informations de commande à au moins un RB adjacent au RB occupé par le bloc SS conformément au mode de mappage prédéterminé comprend en outre:

le mappage de l'ensemble de ressources de commande pour transmettre les informations de commande à au moins un bloc de ressources, RB, adjacent à un RB occupé par un signal de synchronisation primaire, PSS dans le bloc SS.

3. Procédé de transmission d'informations de commande selon la revendication 2, dans lequel l'au moins un RB adjacent au RB occupé par le PSS comprend en outre au moins un RB dans le même domaine temporel que, et dans un domaine fréquentiel différent de celui-ci, le RB occupé par le PSS.
4. Procédé de transmission d'informations de commande selon la revendication 3, dans lequel l'au moins un RB dans le même domaine temporel que le RB occupé par le PSS et dans le domaine fréquentiel différent de celui-ci comprend un premier élément de canal de commande, CCE, composé de N RB consécutifs dans le même domaine temporel que le RB occupé par le PSS et dans un premier domaine fréquentiel, et un second CCE composé de N RB consécutifs dans le même domaine temporel que le RB occupé par le PSS et dans un second domaine fréquentiel,

dans lequel l'au moins un RB dans le même domaine temporel que le RB occupé par le PBCH et dans un domaine fréquentiel différent de celui-ci comprend un troisième CCE composé de N RB consécutifs dans le même domaine temporel que le RB occupé par le PBCH et dans un troisième domaine fréquentiel, et un quatrième CCE composé de N RB consécutifs dans le même domaine temporel que le RB occupé par le PBCH et dans un quatrième domaine fréquentiel,

dans lequel le PSS et le PBCH sont situés à un même point de fréquence centrale et dans des domaines temporels différents, et occupent des largeurs de bande différentes, le PSS occupe un symbole de multiplexage par répartition orthogonale de la fréquence, OFDM, dans le domaine temporel, et le PBCH occupe trois symboles OFDM dans le domaine temporel,

dans lequel une fréquence dans le premier domaine fréquentiel est supérieure à une fréquence dans le domaine fréquentiel où se trouve le PSS, la fréquence dans le domaine fréquentiel où se trouve le PSS est supérieure à une fréquence dans le deuxième domaine fréquentiel, une fréquence dans le troisième domaine fréquentiel est supérieure à une fréquence dans le domaine fréquentiel où se trouve le PBCH, et la fréquence dans le domaine fréquentiel où se trouve le PBCH est supérieure à une fréquence dans le quatrième domaine fréquentiel.
5. Procédé de transmission d'informations de commande selon la revendication 4, dans lequel N = 6.
6. Procédé de transmission d'informations de commande selon la revendication 4, dans lequel l'ensemble de ressources de commande comprend le

premier CCE, le deuxième CCE, le troisième CCE et le quatrième CCE, dans lequel la transmission des informations de commande sur l'au moins un RB occupé par l'ensemble de ressources de commande comprend la transmission des informations de commande sur les RB occupés par le premier CCE, le deuxième CCE, le troisième CCE et le quatrième CCE dans l'ensemble de ressources de commande.

7. Procédé de transmission d'informations de commande selon la revendication 5, comprenant en outre:

le mappage de l'ensemble de ressources de commande pour transmettre les informations de commande, conformément au mode de mappage prédéterminé, au nombre M1 de RB adjacents dans le même domaine temporel que le premier CCE, au nombre M2 de RB adjacents dans le même domaine temporel que le deuxième CCE, au nombre M3 de RB adjacents dans le même domaine temporel qu'un premier symbole OFDM du troisième CCE, nombre M4 de RB adjacents dans le même domaine temporel que le premier symbole OFDM de la quatrième CCE, nombre M5 de RB adjacents dans le même domaine temporel que le deuxième symbole OFDM de la troisième CCE, nombre M6 de RB adjacents dans le même domaine temporel que le deuxième symbole OFDM de la quatrième CCE, nombre M6 de RB adjacents dans le même domaine temporel que le deuxième symbole OFDM de la quatrième CCE, au nombre M7 de RB adjacents dans le même domaine temporel qu'un troisième symbole OFDM du troisième CCE, et au nombre M8 de RB adjacents dans le même domaine temporel qu'un troisième symbole OFDM du quatrième CCE, dans lequel les nombres de M1, M3, M5 et M7 de RB sont situés dans le même cinquième domaine fréquentiel, les nombres M2, M4, M6 et M8 de RB sont situés dans un même sixième domaine fréquentiel, une fréquence dans le cinquième domaine fréquentiel est supérieure à la fréquence dans chacun du premier domaine fréquentiel et du troisième domaine fréquentiel, et une fréquence dans le sixième domaine fréquentiel est inférieure à la fréquence dans chacun du deuxième domaine fréquentiel et du quatrième domaine fréquentiel.
8. Procédé de transmission d'informations de commande selon la revendication 7, dans lequel le nombre de M1 et M3 de RB forme un cinquième CCE, le nombre de M2 et M4 de RB forme un sixième CCE, le nombre de M5 et M7 de RB forme un septième CCE, et le nombre de M6 et M8 de RB forme un huitième CCE.
9. Procédé de transmission d'informations de commande selon la revendication 8, dans lequel

M1=M2=M3=M4=M5=M6=M7=M8=3.

10. Procédé de transmission d'informations de commande selon la revendication 7, dans lequel l'ensemble de ressources de commande comprend le premier CCE, le deuxième CCE, le troisième CCE, le quatrième CCE, le cinquième CCE, le sixième CCE, le septième CCE et le huitième CCE, dans lequel la transmission des informations de commande sur au moins un RB occupé par l'ensemble de ressources de commande comprend:

la transmission des informations de commande sur les RB occupés par le premier CCE, le deuxième CCE, le troisième CCE et le quatrième CCE dans l'ensemble de ressources de commande; et/ou

la transmission des informations de commande sur les RB occupés par le premier CCE, le deuxième CCE, le troisième CCE, le quatrième CCE, le cinquième CCE, le sixième CCE, le septième CCE et le huitième CCE dans l'ensemble de ressources de commande.

11. Procédé de transmission d'informations de commande selon la revendication 1, comprenant en outre:

la transmission (33) d'un mode de multiplexage de l'ensemble de ressources de commande et du bloc SS à l'UE, le mode de multiplexage comprenant le multiplexage par répartition dans le temps ou le multiplexage par répartition en fréquence.

12. Procédé de transmission d'informations de commande selon la revendication 11, dans lequel la transmission (33) du mode de multiplexage de l'ensemble de ressources de commande et du bloc SS à l'UE comprend:

la transmission du mode de multiplexage de l'ensemble de ressources de commande et du bloc SS à l'UE par le biais d'une indication semi-statique.

13. Procédé de transmission d'informations de commande exécuté par un équipement utilisateur, UE, comprenant:

la réception (61) d'un mode de mappage prédéterminé en provenance d'un dispositif de réseau, le mode de mappage prédéterminé étant un mode de mappage dans lequel un ensemble de ressources de commande pour la transmission des informations de commande est mappé par le dispositif de réseau à au moins un bloc de ressources, RB, adjacent à un RB occupé par un bloc de signaux de synchronisation, SS; et

la détection (62) des informations de commande sur l'au moins un RB occupé par l'ensemble de

ressources de commande conformément au mode de mappage prédéterminé,

le procédé de détection d'informations de commande étant **caractérisé en ce que**

l'au moins un RB adjacent au RB occupé par le bloc SS comprend au moins un RB adjacent à un RB occupé par un canal physique de diffusion, PBCH, dans le bloc SS; et

le au moins un RB adjacent au RB occupé par le PBCH comprend au moins un RB dans le même domaine temporel, et dans un domaine fréquentiel différent de celui-ci, que le RB occupé par le PBCH.

14. Dispositif de réseau, comprenant:

un processeur configuré pour mapper (31) un ensemble de ressources de commande pour transmettre des informations de commande à au moins un bloc de ressources, RB, adjacent à un RB occupé par un bloc de signaux de synchronisation, SS, conformément à un mode de mappage prédéterminé; et

un émetteur-récepteur configuré pour transmettre (32) le mode de mappage prédéterminé à l'UE, et pour transmettre les informations de commande à l'UE sur l'au moins un RB occupé par l'ensemble de ressources de commande, le dispositif de réseau étant **caractérisé en ce que**

le processeur est en outre configuré pour: le mappage de l'ensemble de ressources de commande pour transmettre les informations de commande à au moins un RB, adjacent à un RB occupé par un canal physique de diffusion, PBCH, dans le bloc SS conformément à un mode de mappage prédéterminé; et

le au moins un RB adjacent au RB occupé par le PBCH comprend au moins un RB dans un même domaine temporel, et dans un domaine fréquentiel différent de celui-ci, que le RB occupé par le PBCH.

15. Équipement utilisateur, UE, comprenant un émetteur récepteur conçu pour: recevoir (61) un mode de mappage prédéterminé en provenance d'un dispositif de réseau, le mode de mappage prédéterminé étant un mode de mappage dans lequel un ensemble de ressources de commande pour la transmission des informations de commande est mappé par le dispositif de réseau à au moins un bloc de ressources, RB, adjacent à un RB occupé par un bloc de signaux de synchronisation, SS; et détecter (62) les informations de commande sur l'au moins un RB occupé par l'ensemble de ressources de commande conformément au mode de mappage prédéterminé,

l'UE étant **caractérisé en ce que**

l'au moins un RB adjacent au RB occupé par le bloc SS comprend au moins un RB adjacent à un RB occupé par un canal physique de diffusion, PBCH, dans le bloc SS; et

le au moins un RB adjacent au RB occupé par le PBCH comprend au moins un RB dans un même domaine temporel, et dans un domaine fréquentiel différent de celui-ci, que le RB occupé par le PBCH.

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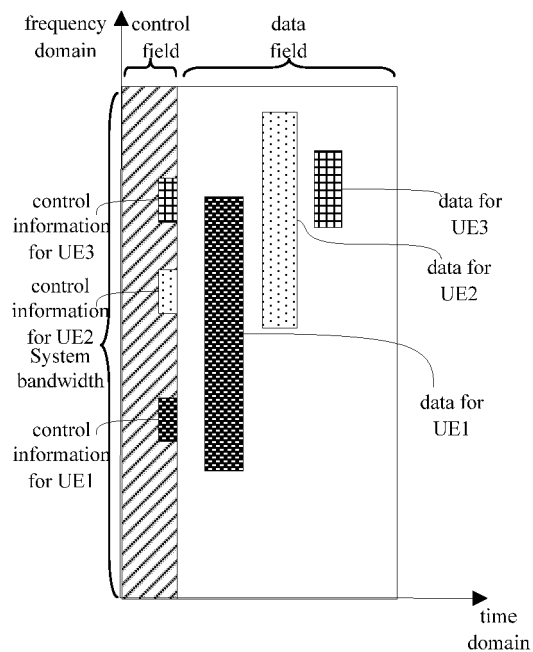


FIG. 1

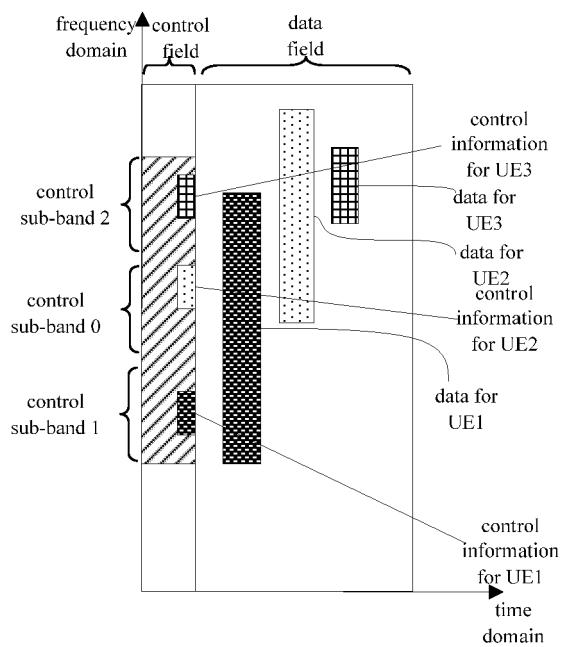


FIG. 2

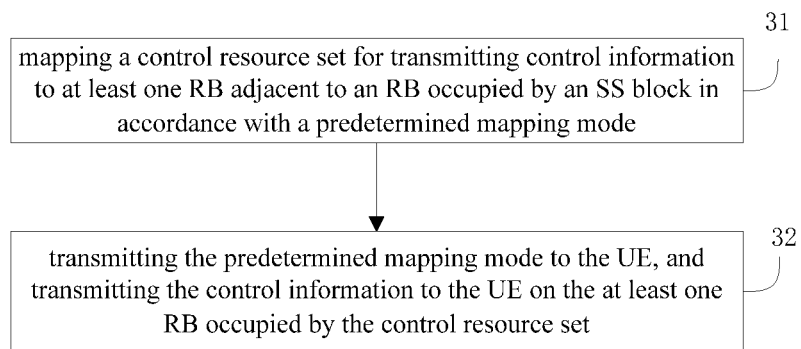


FIG. 3

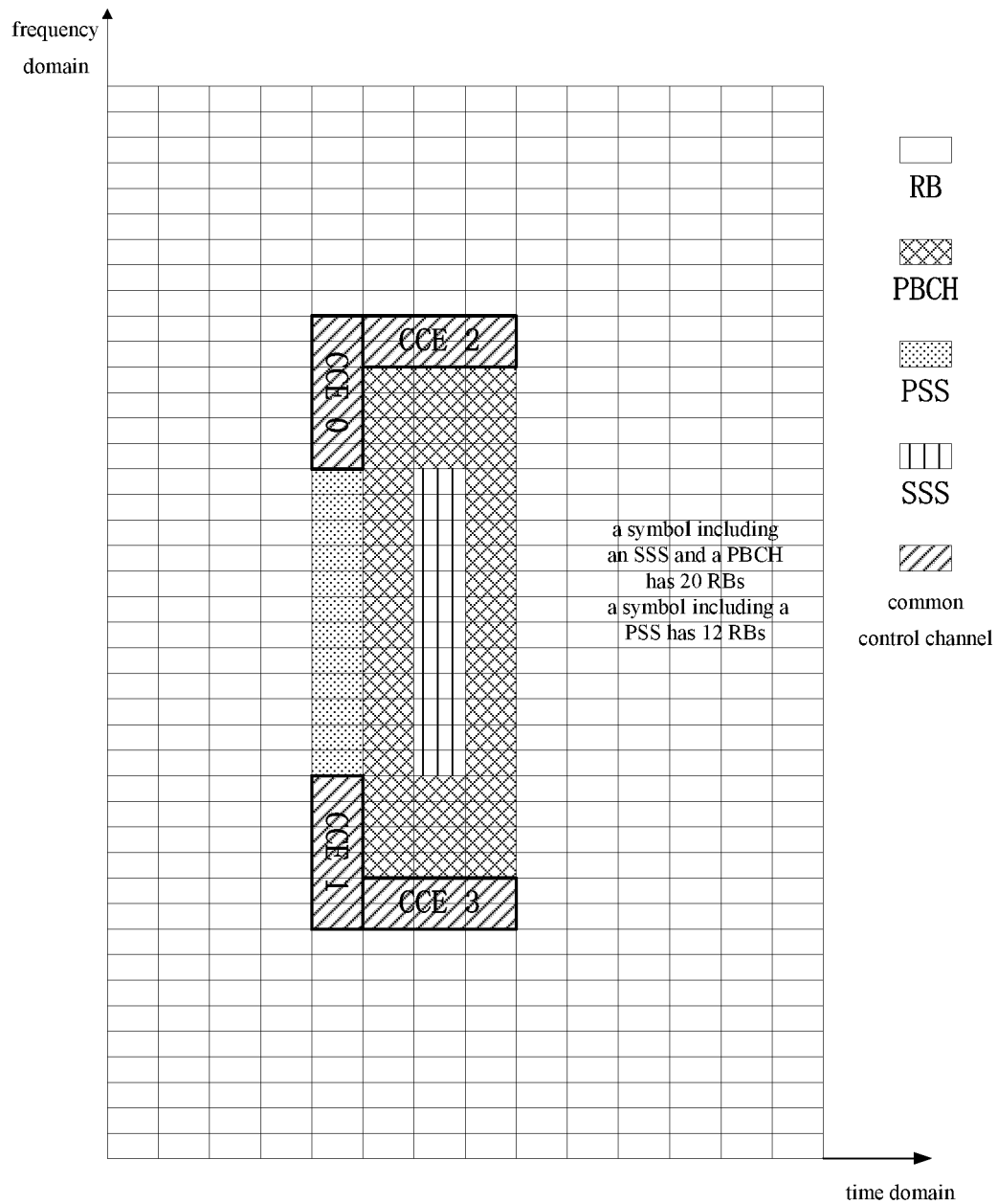


FIG. 4

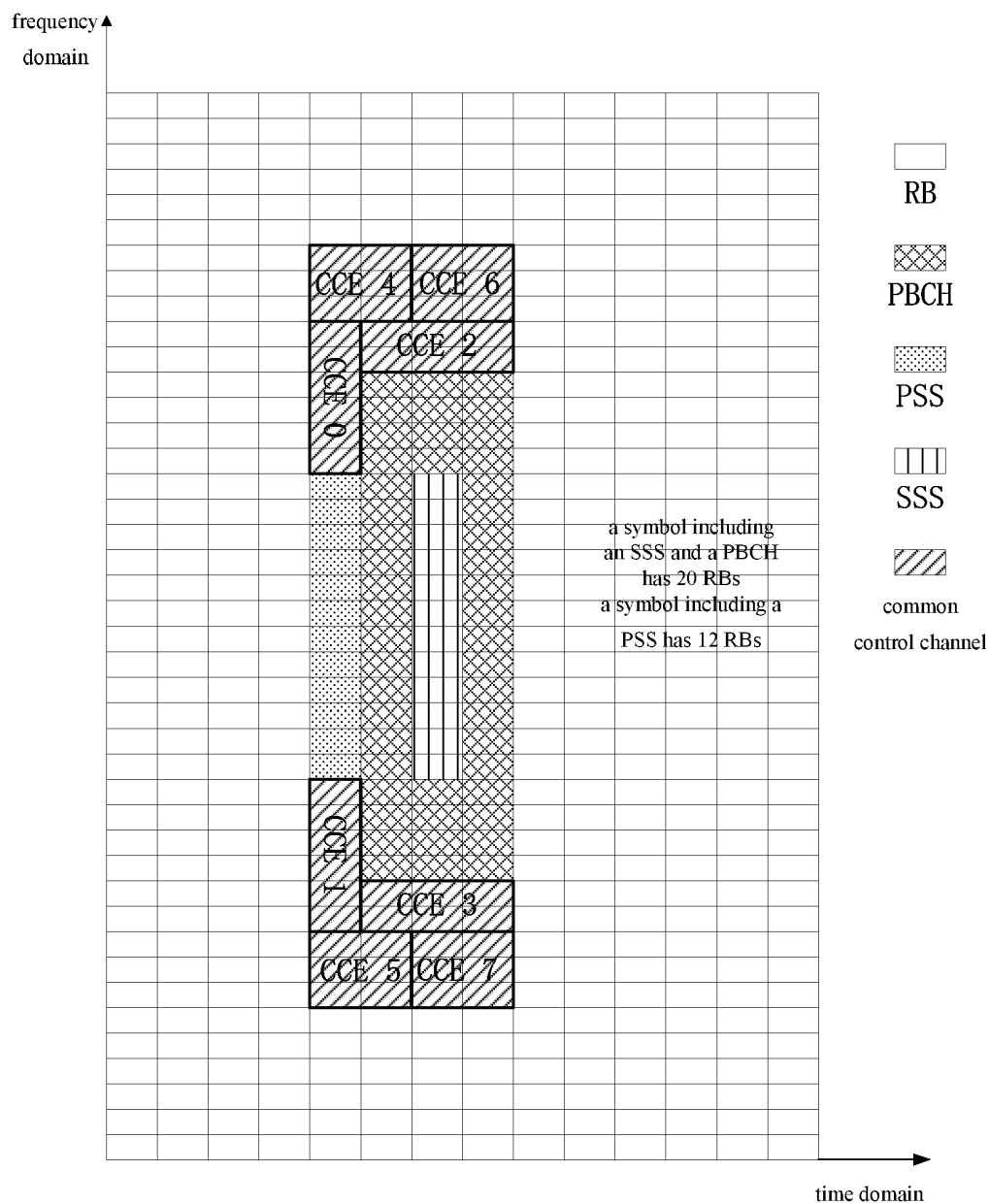


FIG. 5

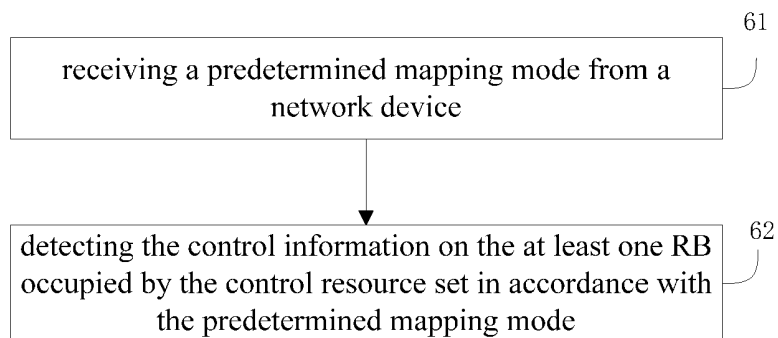


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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- EP 2854455 A1 [0008]
- US 2013201975 A1 [0009]

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- Remaining details on NR-PBCH. 3GPP draft, R1-1716524 [0010]
- Discussion on search space design. 3GPP draft, R1-1717952 [0011]